

June 11, 2008

**Review comments by
Larry Jensen on**

Evaluation of Data Collected Under the Yard 520 Sampling and Analysis Plan

**Pines Area of Investigation
AOC II
Docket No. V-W-'04-C-784**

**ENSR Corp
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Background Samples

- ◆ Generally, U.S. radiation backgrounds for the uranium-238 and thorium-232 natural decay series radionuclides are about 0.5 – 1.5 picocurie per gram (pCi/g). The radiation background for the uranium-235 natural decay series is about 0.046 pCi/g.
- ◆ Radium backgrounds were in the normal range, not exceeding 1 pCi/g.
- ◆ Uranium backgrounds were in the normal range with the exception of site SS018 which was 1.95 pCi/g for uranium-238 when measured by gamma spectrometry.
- ◆ Uranium measurements by inductively Coupled Plasma Mass Spectrometry (ICPMS) list total uranium as the sum of uranium-238 + uranium-235. This is incorrect. Total uranium is the sum of uranium-238 + uranium-234 + uranium-235. It is important to have the uranium-234 level if a conversion from mg/kg to pCi/g is necessary.
- ◆ Results for ICPMS do not contain any uncertainties, nor any detection limits. It is, thus, not possible to judge the quality of the results.
- ◆ U-238 backgrounds by Inductively Coupled Plasma Mass Spectrometry (ICPMS) did not exceed 1 mg/kg except for sites SS008, SS018, and SS021 which were 1, 6.1, and 1 mg/kg, respectively. It should be determined if these were local variations, problem locations, or if there was a malfunction in sample collection or in laboratory measurement. Most especially, SS018 should be investigated.
- ◆ U-235 backgrounds by ICPMS did not exceed 0.009 mg/kg except for sites SS018 and SS022 which were 0.044 and 0.013 mg/kg, respectively. Again, these anomalies should be investigated, especially SS018.
- ◆ The U-238 and U-235 background water concentrations were identical across three sites. Getting the exact concentration in each measurement is unexpected and puzzling. This might be a laboratory issue.

- ◆ The GEL Laboratories water sample results (Sample IDs 202261001 to 202261031) have such high uncertainties that they cannot be used.

Also, the Detection Limits (DL) were set so high that they did not apply to reasonable comparison standards such as the USEPA 40 CFR 192 Total Radium (radium-226 + radium-228) soil standard of 5 picocuries per gram (pCi/g) plus background. This is most likely a problem of not counting the sample long enough. The DL could have been brought down below 5 pCi/g if the sample had been counted longer. As a result, the Total Radium standard could not be compared to the data to determine if there might be contamination.

- ◆ The Total Radium soil background concentration of 0.618 pCi/g is important. It will be discussed in later comments.

Yard 520 Samples

- ◆ The USEPA wrote a total radium standard for the cleanup of uranium and thorium soils, 40 CFR 192. It has been used consistently by USEPA Region 5 and is applicable to Yard 520 for judging the data. The standard is 5 pCi/g plus background for the sum of radium-226 and radium-228 or 5.618 pCi/g for the Pines area.
- ◆ Five of the 11 measured samples exceed 5.618 pCi/g (GP005, GP006, GP007, GP009, and GP010). This is an indication of possible contamination.
- ◆ There is no comparable soil standard for uranium. It is reasonable to compare data to background concentrations.

U-238 (by gamma spectrometry)
range 2.20 - 4.77 pCi/g
range 7 – 15 times the Pines average gamma spectrometry background

U-234 (by gamma spectrometry)
range 2.06 – 5.38 pCi/g
range 7 – 19 times the Pines average gamma spectrometry background

U-235 (by gamma spectrometry)
range 0.0774 – 0.347 pCi/g
range 1.5 – 7 times the Pines average gamma spectrometry background

U-238 (by ICPMS)
range 6.09 – 14.5 mg/kg
range 10 – 23 times the Pines average ICPMS background

U-235 (by ICPMS)
range 0.0445 - 0.105 mg/kg
range 8 – 19 times the Pines average ICPMS background

Some of these sites deviate substantially from their surroundings. The cause(s) should be investigated.

- ◆ There are two standards for judging water samples. These are the Total Radium (Radium-226 + Radium-228) concentration and the Total Uranium (Uranium-238 + Uranium-234 + Uranium-235) concentration found in the USEPA Drinking Water standards (Title 40, Part 141, Code of Federal Regulations, 40 CFR 141). These are 5 picocuries per liter (pCi/L) including background for Total Radium and 30 micrograms per liter (ug/L) including background for Total Uranium .
- ◆ For the one radium water measurement made at GP004 by gamma spectrometry, the Total Radium including background appears to be 20.58 pCi/L or 4 times the standard. However, the uncertainties are higher than the results and the detection limits are well above 5 pCi/L, the USEPA Total Radium standard. These radium in water data are not usable.
- ◆ For the one uranium water measurement made at GP004 by gamma spectrometry, the measurements were made in pCi/L. When converted to ug/L, the Total Uranium level appears to be 479 ug/L or 16 times the standard. Again, however, the uncertainties are higher than the results and the detection limits are well above 30 ug/kg, the USEPA Total Uranium standard. These uranium in water data are not usable.
- ◆ For the one uranium water measurement made at GP004 by ICPMS, the levels are

U-238	4 times the Pines average ICPMS background
U-234	7 times the Pines average ICPMS background
U-235	1.4 times the Pines average ICPMS background
- ◆ The measurements for U-238 and U-235 by gamma spectrometry are not comparable to the measurements by ICPMS. The U-238 and U-235 concentrations by gamma spectrometry, 473.5 ug/L and 5.273 ug/L, respectively, are substantially different from the concentrations by ICPMS, 0.200 ug/L and 0.070 ug/L, respectively. This appears to be an issue with measurement uncertainties.

Sediment Samples

- ◆ When compared to the Total Radium standard (5.618 pCi/g), no sediment sample exceeds this standard.
- ◆ Uranium can be compared to background soil concentrations

U-238 (by gamma spectrometry)	
	range 0.135 – 0.863 pCi/g
	range 0.4 – 3 times the Pines average gamma spectrometry background
U-234 (by gamma spectrometry)	
	range 0.209 – 1.62 pCi/g
	range 0.8 – 6 times the Pines average gamma spectrometry background

U-235 (by gamma spectrometry)
range .0162 – 0.163 pCi/g
range 0.3 – 3 times the Pines average gamma spectrometry background

U-238 (ICPMS)
range 0.160 – 0.890 mg/kg
range 0.3 – 1.4 times the Pines average ICPMS background

U-235 (ICPMS)
range 0.0029 – 0.00657 mg/kg
range 0.5 – 1 times the Pines average ICPMS background

There appears to be somewhat elevated uranium in the sediments.

Conclusions

- ◆ Background soil sample SS018 should be checked to determine why it is anomalously high.
- ◆ Uranium measurements by inductively Coupled Plasma Mass Spectrometry list total uranium as the sum of uranium-238 + uranium-235. This is incorrect. Total uranium is the sum of uranium-238 + uranium-234 + uranium-235.
- ◆ The three background water samples measured by ICPMS for uranium (SS003, SS012, SS021) should be checked to determine why they were identical in every measurement.
- ◆ Five of the 11 Yard 520 soil samples exceed the 40 CFR 192 Total Radium standard. (GP005, GP006, GP007, GP009, GP010). Although the highest is 7.26 pCi/g (standard, 5.618 pCi/g), this nevertheless is indicative of contamination.
- ◆ Uranium concentrations in Yard 520 soil samples were measured to be as much as 23 times Pines' background concentration. The highest was for U-238 at GP008.
- ◆ The single water sample taken at GP004 showed uranium concentrations as high as 7 times the background concentration.
- ◆ It is unclear why measurements for U-238 and U-235 by gamma spectrometry are not comparable to the measurements by ICPMS.
- ◆ No sediment samples exceeded the 40 CFR 192 Total Radium standard.
- ◆ Uranium concentrations in sediments were measured to be as much as 6 times the Pines' background concentration. The highest was for U-234 at SW022.
- ◆ Some measurement uncertainties are so high as to make the results unusable.

- ◆ Some measurement detection limits are so high that the results cannot be compared to reasonable USEPA standards. This appears to be a problem of not counting the samples long enough.
- ◆ ICPMS results have no uncertainties and no detection limits. It is not possible, as a result, to judge the quality of these data.